Fisheries and Oceans Canada | Pêches et Océans Canada
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Science Response 2017/002

Maritimes Region

SCALLOP (*PLACOPECTEN MAGELLANICUS*) IN SCALLOP PRODUCTION AREAS 1 TO 6 IN THE BAY OF FUNDY: STOCK STATUS UPDATE FOR 2016

Context

The objectives of this report are to: identify the consequences of different harvest levels in Scallop Production Areas (SPAs.) 1A, 1B, 3, 4 and 6 for the 2016/2017 season, provide advice on the interim harvest levels for the start of the 2017/2018 season for SPAs 1A, 1B, 3, 4 and 6, and, identify all information on fishery by-catch of non-target species. If information is available, identify any notable changes in occurrence of bycatch species relative to previous years. Interim harvest levels are provided for the following fishing year to allow the fishery to start in October before annual assessment or update results are available (November). The last full assessment of the Bay of Fundy scallop occurred in 2015 (DFO 2016, Nasmith et al. 2016).

This Science Response Report results from the Science Response Process of 17 November, 2016, on the 2016 Stock Status Update of Bay of Fundy Scallop in Scallop Production Areas (SPAs) 1A, 1B, and 3-6.

Background

Population surveys are conducted annually by Fisheries and Oceans Canada (DFO) Science. The population dynamics of commercial and recruit scallops for all SPAs (Appendix 1) were modelled using a Bayesian state-space model with modifications presented in Smith et al. (2012) and Smith and Hubley (2014). In this report, scallops with a shell height of 80 mm and greater are referred to as commercial size. Scallops with a shell height of 65-79 mm are referred to as recruits and are expected to grow to be commercial size in the following year. Scallops less than 65 mm are defined as pre-recruits. Scallop removals accounted for in assessments include landings from all 3 inshore scallop fleets and Food, Social and Ceremonial (FSC) catch when applicable. There was no FSC catch by drag gear in the Bay of Fundy in the 2016 fishing year. There were no fisheries observer trips in the Bay of Fundy scallop fishery in the 2016 fishing year.

Description of the Fishery

The Bay of Fundy inshore scallop fishery is fished by three scallop fleets: Full Bay, Mid Bay, and Upper Bay (Appendix 1). Full Bay license holders are permitted to fish throughout the Bay of Fundy. Mid Bay license holders have access to all areas north of the Mid Bay line. Upper Bay license holders are restricted to the upper reaches of the Bay. The fishery is managed using limited entry, drag gear size limits, seasonal closures, minimum shell height, and meat count. The drag gear width limit is 5.5 metres (m) with a ring size of not less than 82 mm inside diameter. The Full Bay Fleet operates under an Individual Transferable Quota (ITQ) system, while the Mid Bay and Upper Bay fleets fish with competitive quotas. Total Allowable Catches (TACs) are set and landings are reported in terms of meat weights (adductor muscles).

Analysis and Response

Scallop Production Area 1A Stock Status

The Full Bay fleet caught a total of 422.31 tonnes (t) against a TAC of 425 t during the 2016 fishery in SPA 1A. Recent TAC and landings are summarized in Appendix 2. The commercial catch rate in the 2016 fishing year was 39.3 kilograms per hour (kg/h), an increase from 2015 (25.9 kg/h) and above the long-term (1998 to 2015) median of 16 kg/h. The commercial fishery in 2016 was 2 months shorter than in 2015, as the TAC was fully caught earlier in the year. Survey condition (measured in grams per cubic decimeter (g/dm^3)) in 2016 was 11.3 g/dm^3, a decrease from 2015 (13.7 g/dm^3), and at the long-term (1996-2013) mean of 11.2 g/dm^3. Pre-recruits were most abundant in the 8 to 16 mile survey strata (Figure 1 and Appendix 1). The biomass estimate of recruit scallops decreased from 80.5 t in 2015 to 25.9 t in 2016, which was below the long-term (1997-2015) median of 60.4 t. Most of the recruits were seen in the eastern portion of the 8 to 16 mile survey strata (Figure 2 and Appendix 1). Commercial scallop biomass was greatest in the 8 to 16 mile strata, and distribution was most patchy in the Middle Bay South stratum (Figure 3). Commercial population biomass for 2016 estimated by the model was 2,649 (meats), which is in the healthy zone (Figure 4).

Catch scenarios for 2016/2017 are presented in Table 1. For example, Table 1 is interpreted as follows: a catch of 200 t corresponds to an exploitaiton 0.07, and is projected to result in a 2.37% decline in biomass, the probability of biomass increase is 47%, the probability that a catch of 200 t will result in the population remaining above the Lower Reference Point (LRP) is >99%, and the probability of the population remaining above the Upper Stock Reference (USR) is >99%. In the following fishing year (2017/2018), a catch of 238 t would have a probability of 10% of exceeding a reference exploitation of 0.15.

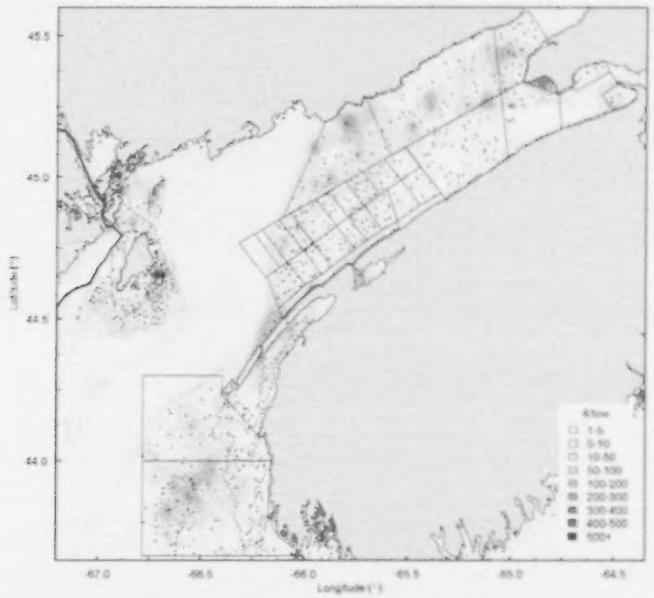

Figure 1. Spatial distribution (number/tow) of pre-recruit scallops (< 65 mm shell height) in the Bay of Fundy and approaches in 2016. Solid black lines are survey strata, dashed black lines are survey strata representing high (inside dashed lines) and low (outside dashed lines) fishing effort, based on vessel monitoring system (VMS) analysis (see: Smith et al. 2012).

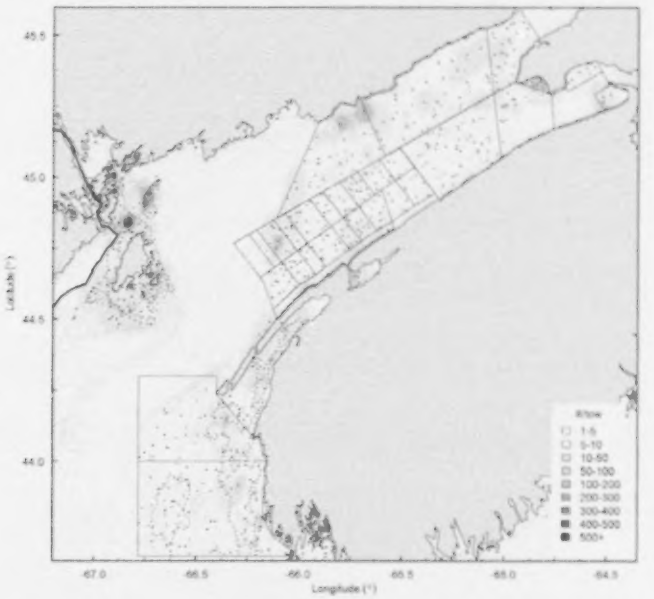

Figure 2. Spatial distribution (number/tow) of recruit scallops (65-80 mm shell height) in the Bay of Fundy and approaches in 2016. Solid black lines are survey strata, dashed black lines are survey strata representing high (inside dashed lines) and low (outside dashed lines) fishing effort, based on vessel monitoring system (VMS) analysis (see: Smith et al. 2012).

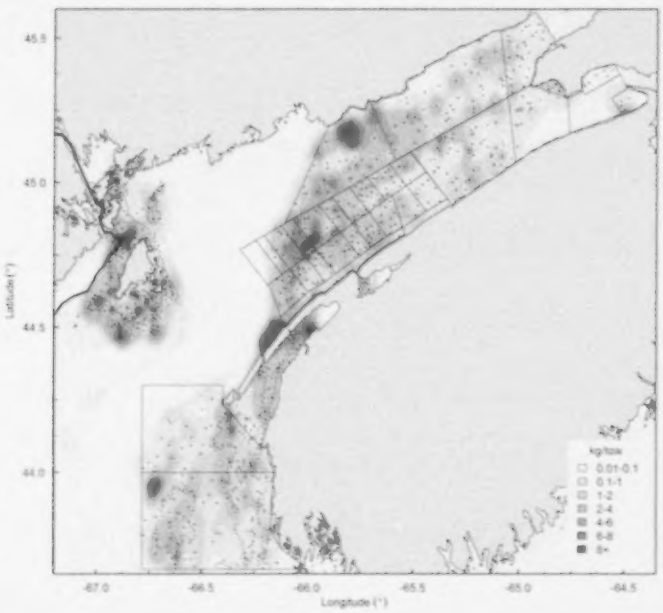

Figure 3. Spatial distribution of commercial (> 80 mm shell height) biomass (kg/tow) in the Bay of Fundy and approaches in 2016. Solid black lines are survey strata, dashed black lines are survey strata representing high (inside dashed lines) and low (outside dashed lines) fishing effort, based on vessel monitoring system (VMS) analysis (see: Smith et al. 2012).

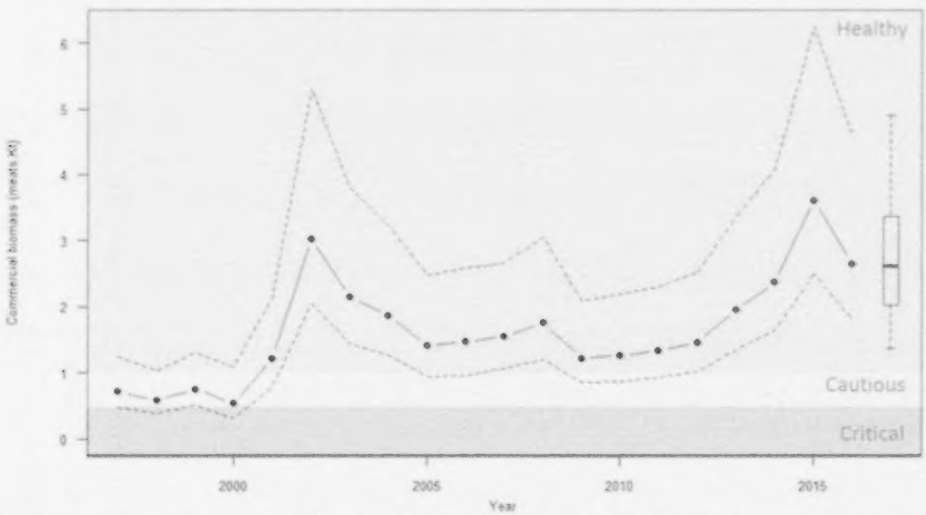

Figure 4. SPA 1A median biomass estimates for commercial size scallops (kt) from the assessment model fit to the survey and commercial data. Dashed lines are the upper and lower 95% credible limits on the estimates. The predicted commercial size biomass for 2017, assuming the 2016/2017 initial TAC (200 t), is displayed as a box plot with median, 50% credible limits (box) and 80% credible limits (whiskers). Green-shaded area represents the healthy zone (based on an Upper Stock Reference point of 1000 t), yellow area represents the cautious zone and red is the critical zone (based on Lower Reference Point (LRP) of 480 t; Nasmith et al. 2014).

Table 1. Harvest scenario table for SPA 1A to evaluate 2016/2017 catch levels in terms of resulting exploitation (e), expected changes in biomass (%), probability (Pr) of biomass increase, probability that after removal the stock will be above the Upper Stock Reference (USR; 1000 t), and above the Lower Reference Point (LRP; 480 t). Potential catches (t) in 2017/2018 are evaluated in terms of the posterior probability of exceeding exploitation rate of 0.15.

2016/2017						Potential Catch (t) 2017/2018 $Pr(e_{2017/2018}) > 0.15$					
Catch (t)	e	% Change	Pr Increase	Pr > LRP	Pr > USR	0.1	0.2	0.3	0.4	0.5	0.6
200	0.07	-2.37	0.47	>0.99	0.99	238	285	322	357	393	432
220	0.08	-3.17	0.46	>0.99	0.99	237	283	319	354	390	429
240	0.09	-3.87	0.45	>0.99	0.99	234	280	317	352	387	426
260	0.09	-4.60	0.44	>0.99	0.99	232	277	314	349	384	424
280	0.10	-5.22	0.43	>0.99	0.99	230	275	311	346	381	420
300	0.11	-6.06	0.42	>0.99	0.99	229	273	309	343	378	417
320	0.11	-6.80	0.41	>0.99	0.99	225	270	306	340	375	414
340	0.12	-7.63	0.39	>0.99	0.99	223	267	303	337	372	410
360	0.13	-8.28	0.38	>0.99	0.98	221	265	301	335	369	408
380	0.14	-9.02	0.37	>0.99	0.98	219	262	298	332	366	405
400	0.14	-9.86	0.36	>0.99	0.98	217	261	295	328	362	400
420	0.15	-10.72	0.35	>0.99	0.98	214	257	292	325	359	396

Scallop Production Area 1B Stock Status

The total 2016 landings for all fleets in SPA 1B was 653.95 t against a combined TAC of 625 t. Full Bay Fleet caught 314.04 t against a quota of 312.21 t, Mid Bay Fleet caught 255.86 t against a quota of 229.6 t, and Upper Bay Fleet caught 84.05 t against a quota of 83.236 t. Recent TAC and landings are summarized in Appendix 2. Catch rates for the Full Bay Fleet increased in Scallop Fishing Area (SFA) 28B (25.8 kg/h in 2015 to 37.9 kg/h in 2016). Full Bay Fleet did not fish in SFAs 28C or 28D. Catch rates for the Mid Bay Fleet increased in both SFAs 28B (22 kg/h in 2015 to 32.9 kg/h in 2016), and 28C (27.4 kg/h in 2015 to 31.1 kg/h in 2016). Catch rates for the Upper Bay Fleet decreased in both SFAs 28C (17.9 kg/h in 2015 to 16.8 kg/h in 2016), and 28D (17 kg/h in 2015 to 16.1 kg/h in 2016). Condition from the survey decreased in all 3 SFAs. Over the entire SPA, condition decreased from 12.3 g/dm^3 in 2015 to 10.5 g/dm^3 in 2016, and was below the long-term (1996-2015) mean of 11.8 g/dm^3. Pre-recruit scallops were observed throughout SPA 1B, with the highest densities in Advocate Harbour (Figure 1). The biomass estimate of recruit scallops decreased from 232.3 t in 2015 to 89.4 t in 2016, and was below the long-term (1997-2015) median of 173.4 t. The highest density patches of recruits were seen in Advocate Harbour and Cape Spencer survey strata (Figure 2 and Appendix 1). Commercial biomass was patchy in SPA 1B with the beds of highest biomass in Cape Spencer stratum (Figure 3). Commercial population biomass for 2016 estimated by the model was 3175 t (meats), which is in the healthy zone (Figure 5). Catch scenarios for 2016/2017 are presented in Table 2. See SPA 1A Stock Status section in this document for an example of interpreting the table.

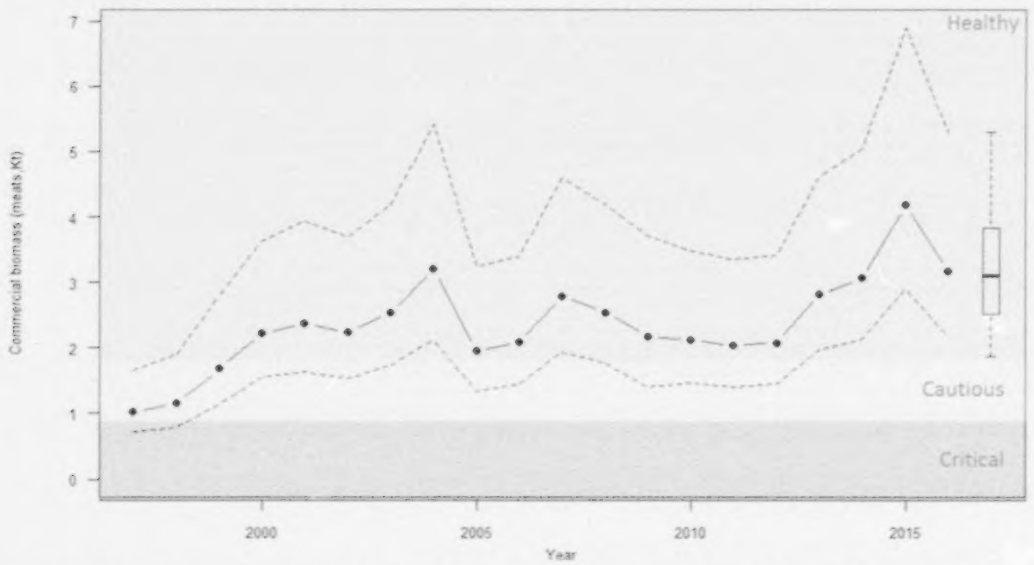

Figure 5. SPA 1B median biomass estimates for commercial size scallops (kt) from the assessment model fit to the survey and commercial data. Dashed lines are the upper and lower 95% credible limits on the estimates. The predicted commercial size biomass for 2017, assuming the 2016/2017 interim TAC (200 t), is displayed as a box plot with median, 50% credible limits (box) and 80% credible limits (whiskers). Green-shaded area represents the healthy zone (based on an Upper Stock Reference of 1800 t), yellow area represents the cautious zone and red is the critical zone (based on Lower Reference Point of 880 t; Nasmith et al. 2014).

Table 2. Harvest scenario table for SPA 1B to evaluate 2016/2017 catch levels in terms of resulting exploitation (e), expected changes in biomass (%) , probability (Pr) of biomass increase, probability that after removal the stock will be above the Upper Stock Reference (USR; 1800 t), and above the Lower Reference Point (LRP; 880 t). Potential catches (t) in 2017/2018 are evaluated in terms of the posterior probability of exceeding exploitation rate of 0.15.

2016/2017						Potential Catch (t) 2017/2018 $Pr(e_{2017/2018}) > 0.15$					
Catch (t)	e	% Change	Pr Increase	Pr > LRP	Pr > USR	0.1	0.2	0.3	0.4	0.5	0.6
200	0.06	-3.16	0.44	>0.99	0.96	313	359	396	431	466	504
300	0.09	-6.25	0.38	>0.99	0.95	301	346	382	416	450	488
320	0.10	-6.97	0.36	>0.99	0.95	298	343	379	413	446	484
340	0.10	-7.71	0.35	>0.99	0.94	296	340	377	409	443	480
360	0.11	-8.18	0.34	>0.99	0.94	294	338	374	407	441	479
380	0.12	-8.82	0.33	>0.99	0.94	291	335	371	404	438	476
400	0.12	-9.56	0.31	>0.99	0.93	289	333	368	401	434	472
420	0.13	-10.15	0.30	>0.99	0.93	286	329	365	398	432	469
440	0.13	-10.81	0.29	>0.99	0.93	284	327	362	395	429	465
460	0.14	-11.44	0.28	>0.99	0.92	281	325	359	392	425	462
480	0.15	-12.04	0.27	>0.99	0.92	279	321	356	389	423	460

Scallop Production Area 2

This area is considered to be marginal habitat for scallops and is not monitored regularly. SPA 2 was last assessed in 2006 (DFO 2007).

Scallop Production Area 3 Stock Status

Total landings for the 2016 fishing year were 223.69 t against a TAC of 225 t. Recent TAC and landings are summarized in Appendix 2. Commercial catch rate in 2016 for St. Mary's Bay was 23.7 kg/h, a decrease from 2015 (26.9 kg/h). June catch rates for the Brier/Lurcher area in 2016 were 17.2 kg/h, a decrease from 2015 (23.2 kg/h), and catch rates in Brier/Lurcher in the fall of 2015 were 20.9 kg/h, a decrease from 22.8 kg/h in 2014. The survey and analysis for SPA 3 is based on two areas defined by vessel monitoring system (VMS) fishing patterns from 2002-2010 (Smith et al. 2012). The best condition was observed in St. Mary's Bay. Condition for SPA in 2016 was 11.3 g/dm^3, a decrease from 2015 (14.1 g/dm^3), and below the long-term (1996-2015) mean of 12.1 g/dm^3. Pre-recruits were not widespread throughout SPA 3, many tows had no pre-recruits (Figure 1). The biomass estimate of recruit scallops for 2016 was 34.6 t, a decrease from 123.3 t in 2015, and below the long-term (1996-2015) median of 73.7 t. Recruits were mainly distributed in the Inside VMS area and St. Mary's Bay with very few recruits seen west of 66.5°W (Figure 2). Commercial biomass distribution was patchy, with greater biomass generally found inside the VMS areas and in St. Mary's Bay (Figure 3). Commercial population biomass for 2016 estimated by the model was 2221 t (meats), which is in the healthy zone (Figure 6). Catch scenarios for 2016/2017 are presented in Table 3. See SPA 1A Stock Status section in this document for an example of interpreting the table.

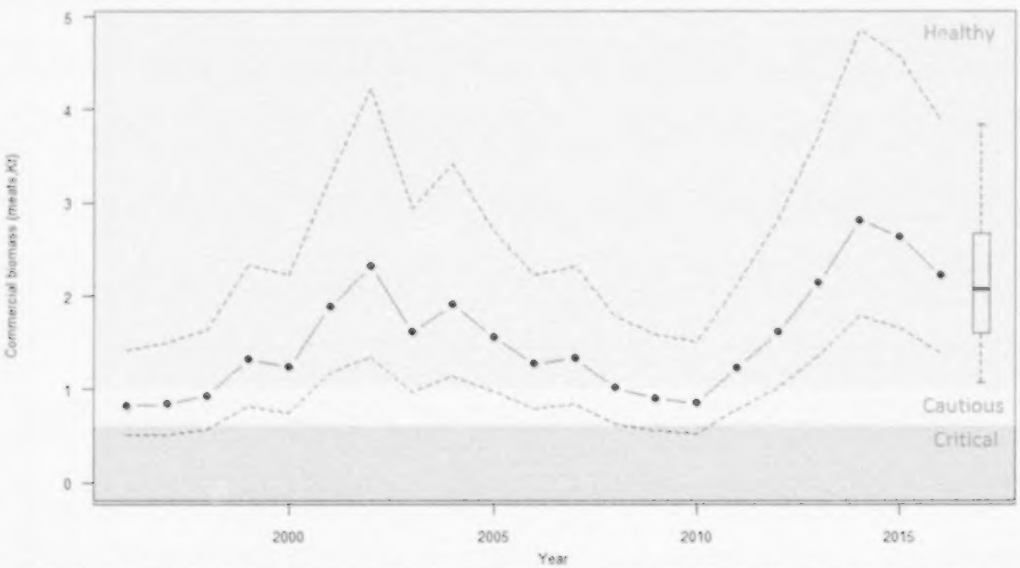

Figure 6. SPA 3 median biomass estimates for commercial size scallops (kt) from the assessment model fit to the survey and commercial data. Dashed lines are the upper and lower 95% credible limits on the estimates. The predicted commercial size biomass for 2017, assuming the 2016/2017 interim TAC (150 t), is displayed as a box plot with median, 50% credible limits (box) and 80% credible limits (whiskers). Green-shaded area represents the healthy zone (based on an Upper Stock Reference of 1000 t), yellow area represents the cautious zone and red is the critical zone (based on Lower Reference Point of 600 t; Nasmith et al. 2014).

Table 3. Harvest scenario table for SPA 3 to evaluate 2016/2017 catch levels in terms of resulting exploitation (e), expected changes in biomass (%) , probability (Pr) of biomass increase, probability that after removal the stock will be above the Upper Stock Reference (USR; 1000 t), and above the Lower Reference Point (LRP; 600 t). Potential catches (t) in 2017/2018 are evaluated in terms of the posterior probability of exceeding exploitation rate of 0.15.

2016/2017						Potential Catch (t) 2017/2018 $Pr(e_{2017/2018}) > 0.15$					
Catch (t)	e	% Change	Pr Increase	Pr > LRP	Pr > USR	0.1	0.2	0.3	0.4	0.5	0.6
150	0.07	-7.92	0.37	>0.99	0.97	189	226	255	282	311	343
170	0.08	-8.70	0.36	>0.99	0.96	187	224	253	281	309	340
200	0.09	-10.29	0.33	>0.99	0.96	182	219	248	276	304	334
220	0.10	-10.91	0.32	>0.99	0.96	182	217	246	273	301	332
230	0.10	-11.48	0.31	>0.99	0.96	180	216	244	271	300	330
240	0.11	-11.85	0.31	>0.99	0.95	179	214	243	270	298	328
250	0.11	-12.26	0.30	>0.99	0.95	178	213	242	270	297	328
260	0.12	-12.94	0.29	>0.99	0.95	175	211	240	267	295	326
280	0.13	-13.55	0.28	>0.99	0.95	174	209	238	265	293	323
290	0.13	-14.06	0.28	>0.99	0.95	173	208	237	263	291	321
300	0.14	-14.54	0.26	>0.99	0.94	171	206	234	262	288	319
320	0.14	-15.54	0.25	>0.99	0.94	169	204	233	259	286	315
330	0.15	-15.83	0.25	>0.99	0.94	168	203	231	259	285	315

Scallop Production Areas 4 and 5 Stock Status

As of the 2014 fishing year, SPA 5 was joined with SPA 4 under one TAC. Total landings in the 2016 fishing year were 227.79 t in SPA 4 and 6.49 t in SPA 5 against a combined TAC of 250 t. Recent TAC and landings are summarized in Appendix 2. Commercial catch rates in SPA 4 in 2016 were 31.2 kg/h, an increase from 2015 (22.5 kg/h) and above the long-term (1982-2015) median of 18.6 kg/h. Commercial catch rate in SPA 5 in 2016 was 24.1 kg/h, an increase from 2015 (20 kg/h) and above the long-term (1977-2015) median of 19.2 kg/h. Condition in SPA 4 in 2016 was 11.4 g/dm^3, a decrease from 2015 (14 g/dm^3) and near the long-term (1996-2015) average of 11.1 g/dm^3. Pre-recruits were observed in parts of SPA 4, but were not evenly distributed within the area (Figure 1). The biomass estimate of recruit scallops in 2016 was 9.4 t, a decrease from 23.1 t in 2015 and below the long-term (1983-2015) median of 39.4 t. Recruits were only present in a few strata (Figure 2). The distribution of commercial biomass in this area was relatively uniform (Figure 3). Commercial population biomass for 2016 estimated by the model was 1548 t (meats) which is in the healthy zone (Figure 7). Catch scenarios for 2016/2017 are presented in Table 4. See SPA 1A Stock Status section in this document for an example of interpreting the table.

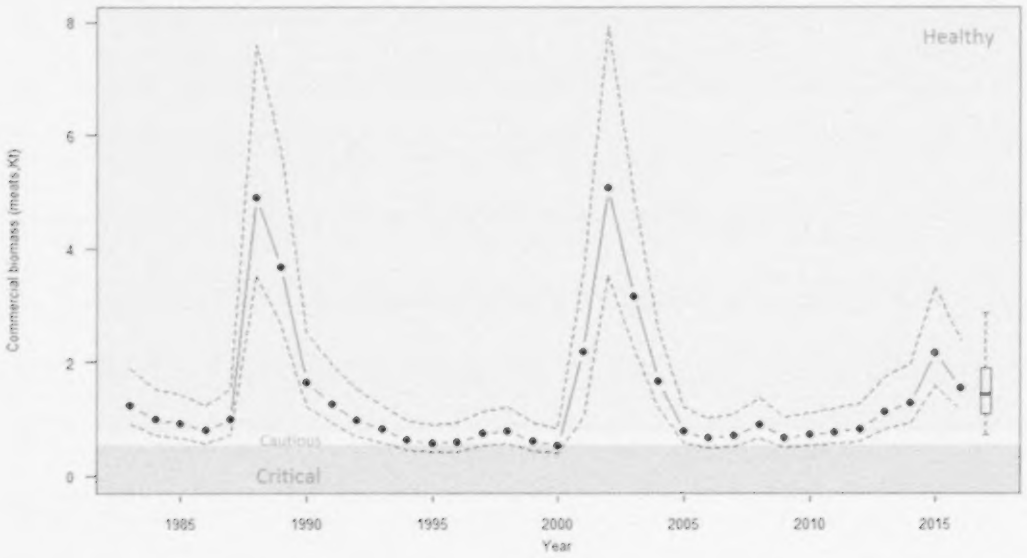

Figure 7. SPA 4 median biomass estimates for commercial size scallops (kt) from the assessment model fit to the survey and commercial data. Dashed lines are the upper and lower 95% credible limits on the estimates. The predicted commercial size biomass for 2017, assuming the 2016/2017 interim TAC (125 t), is displayed as a box plot with median, 50% credible limits (box) and 80% credible limits (whiskers). Green-shaded area represents the healthy zone (based on an Upper Stock Reference of 750 t), yellow area represents the cautious zone and red is the critical zone (based on Lower Reference Point of 530 t; Nasmith et al. 2014).

Table 4. Harvest scenario table for SPA 4 to evaluate 2016/2017 catch levels in terms of resulting exploitation (e), expected changes in biomass (%), probability (Pr) of biomass increase, probability that after removal the stock will be above the Upper Stock Reference (USR; 750 t), and above the Lower Reference Point (LRP; 530 t). Potential catches (t) in 2017/2018 are evaluated in terms of the posterior probability of exceeding exploitation rate of 0.15.

2016/2017						Potential Catch (t) 2017/2018 $Pr(e_{2017/2018}) > 0.15$					
Catch (t)	e	% Change	Pr Increase	Pr > LRP	Pr > USR	0.1	0.2	0.3	0.4	0.5	0.6
125	0.08	-8.30	0.40	0.99	0.94	127	153	175	195	216	240
150	0.10	-9.93	0.38	0.99	0.94	125	150	171	191	212	235
160	0.10	-10.38	0.38	0.99	0.93	124	149	170	190	211	234
170	0.11	-11.07	0.37	0.99	0.93	123	148	169	189	209	232
180	0.12	-11.79	0.36	0.99	0.93	122	147	168	187	208	231
190	0.12	-12.50	0.35	0.99	0.93	121	146	166	186	206	229
200	0.13	-13.09	0.35	0.99	0.93	120	145	165	185	205	228
210	0.13	-13.75	0.34	0.99	0.92	119	143	163	183	203	225
220	0.14	-14.35	0.33	0.99	0.92	118	142	163	182	202	224
230	0.15	-15.09	0.32	0.98	0.91	117	141	161	180	200	222

The annual survey in SPA 5 was discontinued in 2009 after consultation with Industry, and the sampling effort was redirected to other areas in the Bay of Fundy. Since the 2014 survey, a small number of tows have been conducted in SPA 5 annually. The average number of commercial size scallops per tow (scallops/tow) was 290.9, above the historic long-term (1990-

2008) median for the area of 79.5 commercial sized scallops/tow. The weight per tow in 2016 was 3.5 kilograms per tow (kg/tow), also above the historic long-term (1990-2008) median of 1.4 kg/tow. The average number of recruit sized scallops per tow (recruits/tow) was 58.6, and recruit weight per tow was 0.26 kg/tow, both above the historic long-term (1990-2008) recruit medians of 22.3 recruits/tow and 0.1 kg/tow.

Scallop Production Area 6 Stock Status

Total landings for Full Bay and Mid Bay fleets in the 2016 fishing year were 226.82 t against a combined TAC of 250 t. Full Bay Fleet caught 13.57 t against a quota of 38.754 t, and Mid Bay Fleet caught 213.25 t against a quota of 211.242. Recent TAC and landings are summarized in Appendix 2. The commercial catch rate series starting in 1997 for all subareas combined is the stock status indicator for this area, the LRP is 6.2 kg/h, the lowest catch rate observed in the time series since 1997, and the USR is 9.1 kg/h based on the average catch rate from 2005 to 2011. In 2016, the catch rate across all areas was 20.9 kg/h, a slight increase from 2015 (20.2 kg/h) and above the LRP (Figure 8). Catch rates from 1997 to 2001 are not presented in Figure 8 due to a change in the commercial log system implemented in 2002.

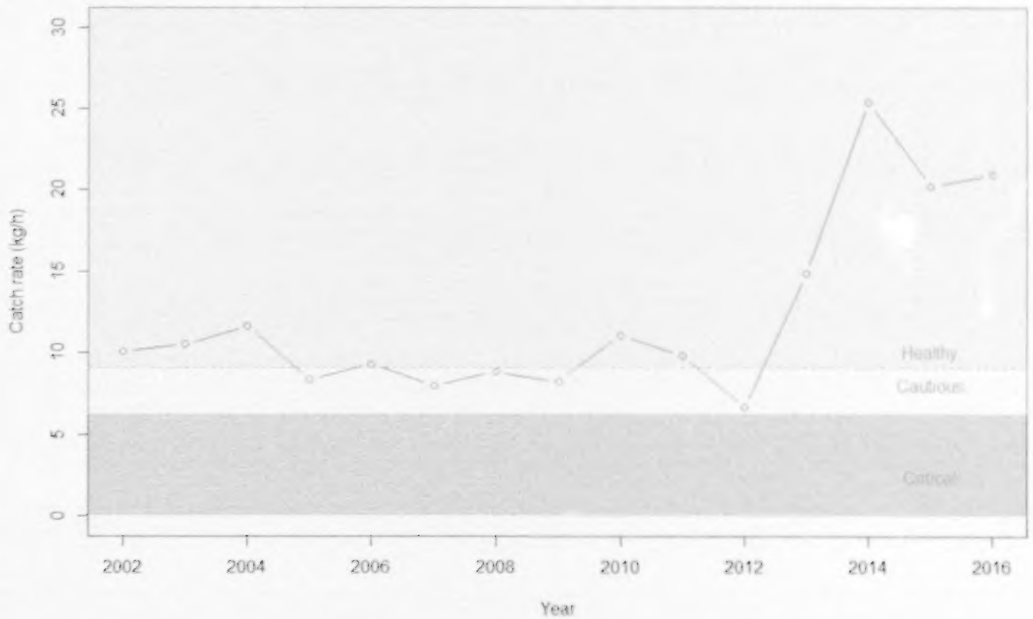

Figure 8. Annual commercial catch rate (kg/h) for SPA 6 for all subareas and both fleets combined. Green-shaded area represents the healthy zone (based on an Upper Stock Reference of 9.1 kg/h), yellow area represents the cautious zone and red is the critical zone (based on Lower Reference Point of 6.2 kg/h).

The survey and analysis for SPA 6 is based on two areas defined by VMS fishing patterns from 2002-2014, following the method used in SPA 3 (Smith et al. 2012; Nasmith et al. 2015). Indices were calculated separately for the fished area (Inside VMS), and the unfished areas (Outside VMS). Condition in the Inside VMS area was 10.4 g/dm^3 in 2016, a slight decrease from 2014 (10.9 g/dm^3) and slightly below the long-term (1997-2015) mean of 11 g/dm^3. Condition in the Outside VMS area in 2016 was 10.3 g/dm^3, a slight decrease from 2015 (10.8 g/dm^3) and near the long-term (1997-2015) mean of 10.9 g/dm^3. Pre-recruits were present throughout the SPA,

with the highest densities near Duck Island Sound (Figure 1 and Appendix 1). The biomass estimate of recruit scallops in 2016 was 213.1 t, an increase from 146.8 t in 2015 and well above the long-term (2006-2015) median of 43.4 t. Recruit scallops were present throughout the area, with the highest density occurring north of Grand Manan Island (Figure 2). Commercial biomass in this area was well distributed (Figure 3). Commercial population biomass for 2016 estimated by the model was 1131 t (meats; Figure 9). Catch scenarios for 2016/2017 are presented in Table 5. For example, Table 5 is interpreted as follows: a TAC of 140 t corresponds to an exploitaiton of 0.10, and is projected to result in a 16.07% increase in biomass, and the probability of biomass increase is 62%.

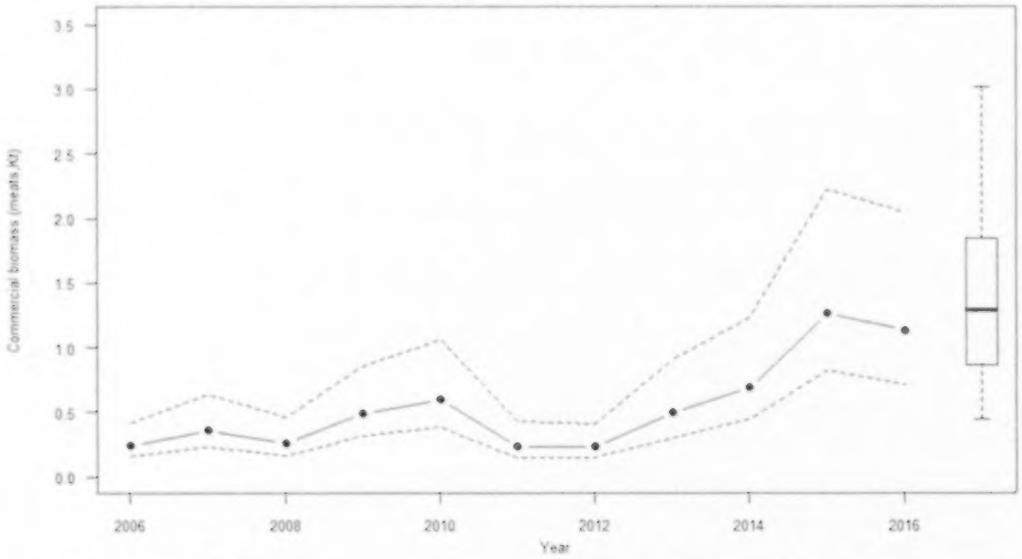

Figure 9. SPA 6 median biomass estimates for commercial size scallops (kt) from the assessment model fit to the survey and commercial data. Dashed lines are the upper and lower 95% credible limits on the estimates. The predicted commercial size biomass for 2017, assuming a catch of 200 t in 2017), is displayed as a box plot with median, 50% credible limits (box) and 80% credible limits (whiskers).

Table 5. Harvest scenario table for SPA 6 to evaluate 2016/2017 catch levels in terms of resulting exploitation (e), expected changes in biomass (%), and probability (Pr) of biomass increase.

Catch (t)	*e*	% Change	Pr Increase
100	0.07	18.85	0.64
120	0.08	17.20	0.63
140	0.10	16.07	0.62
160	0.11	14.18	0.61
180	0.12	12.67	0.60
200	0.14	11.68	0.59
220	0.15	10.01	0.58

Ecosystem Considerations

There were no fisheries observer trips in the Bay of Fundy scallop fishery in the 2016 fishing year. Refer to Sameoto and Glass (2012) for past analysis of discards from the inshore scallop fishery.

Conclusions

Scallop condition declined in all SPAs in the Bay of Fundy in 2016. The biomass estimate of recruit scallops declined in all SPAs with the exception of SPA 6. Despite the decline of commercial biomass in all SPAs, estimates of commercial biomass for all SPAs remain in the healthy zone.

Contributors

Leslie Nasmith (Lead)	DFO Science, Maritimes
Amy Glass	DFO Science, Maritimes
David Keith	DFO Science, Maritimes
Brad Hubley (Reviewer)	DFO Science, Maritimes
Daphne Themelis (Reviewer)	DFO Science, Maritimes
Lottie Bennett	DFO Science, Maritimes
Christa Waters	DFO Fisheries Management, Maritimes

Approved by

Alain Vézina
Regional Director of Science
DFO Maritimes Region
Dartmouth, Nova Scotia
Ph. 902-426-3490
Date: December 2, 2016

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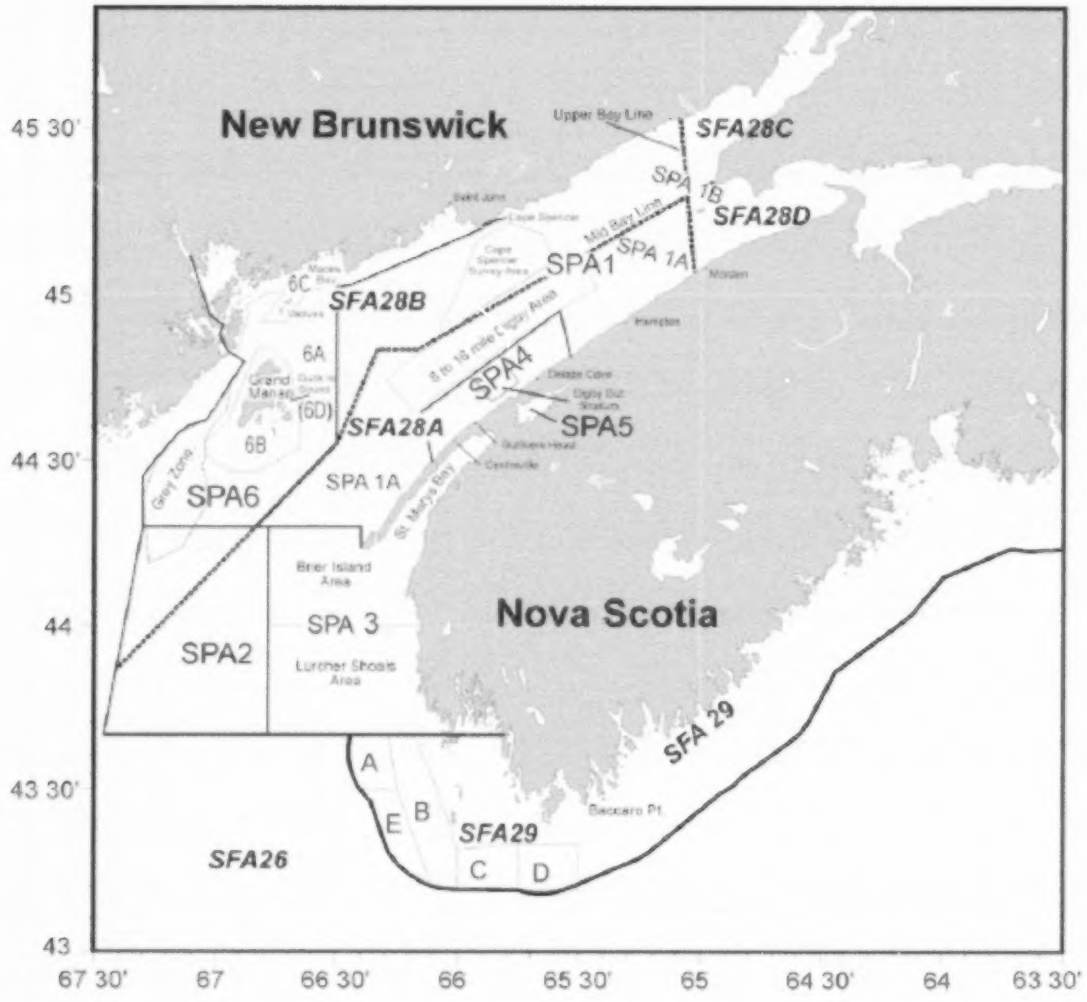
Appendix 1

Map of Scallop Production Areas (SPA) and Scallop Fishing Areas (SFA) in the Bay of Fundy and approaches.



Appendix 2

Summary of Total Allowable Catch (TAC) and landings in tonnes (t), for Full Bay, Mid Bay and Upper Bay fleets by Scallop Production Area (SPA) for 2010 to 2016. Note SPA 4 and 5 were joined under one TAC in 2014, for landings and TAC prior to 2014 see Nasmith et. al (2016).

Area	Fleet		2010	2011	2012	2013	2014	2015	2016
SPA 1A	Full Bay	Landings	297	278.1	206.4	206.02	274.49	361.55	422.31
		TAC	300	300	200	200	275	350	425
SPA 1B	Full Bay	Landings	151.9	84.2	159.9	202.8	229.4	303.96	314.04
		TAC	205.5	203	152.3	190.3	228.4	301.8	312.21
SPA 1B	Mid Bay	Landings	138.6	123.3	103.1	162.7	197.7	164.02	255.86
		TAC	144.7	142.9	107.2	133.95	160.74	175.6	229.6
SPA 1B	Upper Bay	Landings	54.4	54.7	39.97	57.4	68.9	78.2	84.05
		TAC	54.8	54.1	40.6	50.7	60.9	72.7	83.236
SPA 3	Full Bay	Landings	56	72.96	264.8	261	265.1	234.96	223.69
		TAC	50	50	300	260	260	250	225
SPA 4 and 5	Full Bay	Landings	-	-	-	-	102.5	132.35	234.277
		TAC	-	-	-	-	110	135	250
SPA 6	Full Bay	Landings	0.07	0	0.88	8.1	18.2	23.99	13.57
		TAC	21	21	21	21	32.55	37.77	38.754
SPA 6	Mid Bay	Landings	102.5	103.9	54.7	117.5	196.8	207.01	213.25
		TAC	119	119	119	119	184.45	202.23	211.242

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Maritimes Region
Fisheries and Oceans Canada
1 Challenger Drive, PO Box 1006
Dartmouth, Nova Scotia B2Y 4A2
Canada

Telephone: 902-426-7070
E-Mail: XMARMRAR@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

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